Chapter 7

FINDINGS AND CONCLUSIONS

In 1990, Louisiana Senator John Breaux introduced federal legislation enacted as the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) to partially restore the coastal ecosystem (Stead and Hill 2004). Stone is a commonly used feature in CWPPRA projects and there is widespread cultural acceptance of importing stone into coastal Louisiana. One possible explanation is that projects with stone features are completed more quickly than other types of CWPPRA projects. Used as a construction material for centuries, the results of its placement in coastal Louisiana are immediate and highly visible. In addition, the results for other types of CWPPRA projects are not as immediate. Despite the initial favorable impression, long-term performance of stone structures is questionable in many locations due to poor soil conditions and the ongoing and unaddressed interior land loss. The CWPPRA program's continuing and increasing emphasis on placing stone structures ignores 70% of the causes of land loss.

7.1 Comparison of Diverse Restoration Strategies

The effectiveness of projects using stone features in coastal Louisiana is directly related to site-specific conditions and localized causes of land loss. A review of four representative CWPPRA projects using stone revealed that only one project maintained

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its design elevation and effectiveness. It is important to note that this project area appeared to have minimal interior loss rates, was located in the Chenier plain, and land loss was attributed to small boat traffic. CWPPRA stone structures placed in two barrier island locations indicate questionable effectiveness. Stone structures remain stationary in the dynamic Gulf of Mexico environment, while littoral sediments continue their migration along the coastline.

A more sustainable and environmentally preferable solution is to fill in open water areas by strategically placing sediments to raise the elevation of the land. This solution offers a direct response to ongoing subsidence and rise in sea level. Marsh creation projects are not a new restoration alternative within the CWPPRA program. The Bayou La Branche Wetland Creation Project (PO-17) completed in 1994 exemplifies the long-term success that can be achieved by marsh creation projects in addressing interior wetland losses. Barrier island restoration by placing sediments is also successful and a much needed natural component in reducing the impacts of storm surges and protecting interior wetlands. The Timbalier Island Dune and Marsh Restoration (TE-40) CWPPRA project withstood the waves of hurricanes Katrina and Rita with minimal material movement, demonstrating the resilience of placing sands to rebuild barrier island features and extend their physical presence.

To date, the sources of sediment for CWPPRA projects have primarily been from the local coastal zone. The current methodology of borrowing local material, already within the system, and moving this sediment from one location to another within the coastal area does not result in a sustainable restoration. Due to natural processes and the sediment-

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starved conditions in coastal Louisiana, renourishment is needed on a regular basis to sustain the barrier islands. Borrow site searches are expensive and labor intensive. Modeling is also required to ensure the excavation and removal of sediment or sand does not adversely impact wave patterns and increase wave forces. Suitable locations are often limited by pipelines and oil infrastructure, cultural resources, and excessive overburden. Dredging has environmental consequences to the benthic community. Nearshore sources are limited, but the need for material will continue, and therefore auxiliary sources of material are necessary. Importing sediments to restore open water areas and sands for barrier islands holistically benefits the coastal Louisiana environment instead of sacrificing one local environment for the sake of another.

7.2 Regional Approach to Beneficial Use

Historically, the Mississippi River meandered freely, continually nourishing the marshes and depositing its sediment, building land and offsetting the natural and ongoing processes of subsidence and rise in sea level. Flood control projects now trap sediment upstream and levees isolate the river from the coastal lands. Beneficially using all of the dredged material from the Mississippi River is an initial step.

The USACE New Orleans District dredged material is a cost effective source of materials. To facilitate its use, coordination with New Orleans District Operations Division personnel responsible for maintenance dredging should begin immediately. By establishing project areas suitable for immediate placement, or temporary stockpile/storage locations for later use, well in advance of the dredging cycles, the

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likelihood of beneficial use would be maximized. The CWPPRA Task Force should ensure federal project sponsors are designated so site selection activities take place as soon as possible and that project dollars are readily available to supplement the added costs of beneficial use. The annual volume dredged by the USACE, New Orleans District, could address as much as 70% of the ongoing annual land loss; however, additional materials and measures are needed to offset the remaining annual land loss and restore the ground lost over the last 70 years.

Suitable material may be available within the Mississippi River, however, it is limited in quantity and its exact location is uncertain and changing. Extracting river sediments may also impact navigation and stability of the levees. Local coastal zone sands are limited, and large offshore sand deposits for barrier island restoration are regulated by MMS and considered non-renewable.

The issues and feasibility of transporting the dredged materials by barge to coastal Louisiana were investigated. Although usage of this material is currently estimated to cost more than local materials compared to previous and pre-hurricane CWPPRA contract awards, cost sharing opportunities exist to make usage of imported sediment more economically competitive. Three sources of material have been identified and are suitable for placement in coastal Louisiana:

- dredged material from the Illinois Waterway System;
- MKARNS sediment; and,
- sand from the BWT.

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Various types of materials are readily available, including sand for replenishing barrier islands, and silts/clays/sands for marsh restoration. Material can be strategically selected and placed to suit the particular needs of the local environment, instead of relying upon expensive and limited geophysical and geotechnical information. In the case of the Illinois Waterway and MKARNS sediments, this material would have been naturally transported by the rivers to coastal Louisiana to rebuild the land if upstream engineering structures had not been constructed. These materials will be dredged regardless of their final disposition. Importing and utilizing dredged materials to rebuild land in coastal Louisiana eliminates the need for upland storage sites and avoids the additional adverse impacts associated with creating storage sites. By importing sediments, three environments are benefited:

- coastal Louisiana receives much needed sediment to add elevation;
- impacts to a local borrow source location are avoided; and,
- demand for additional upland storage locations is eliminated.

This is in stark contrast to the current methodology of disrupting one local area to provide questionable benefits to another. By importing materials, detrimental impacts of local dredging such as additional consumption of fossil fuels and associated emissions would be avoided.

Transporting sediments by barge to Louisiana to rebuild the landscape will cost more than local borrow and result in additional PM 10 emissions due to the large volumes of material transported. Considering the overall environmental effects and need for a sustainable restoration, importing sediments is a viable and environmentally preferable solution.

7.3 Results of Statistical Analysis of CWPPRA Projects

Shoreline protection type projects represent a little over 19% of the CWPPRA projects approved by the CWPPRA Task Force over the last 16 years, and 30% of all CWPPRA projects have a designated shoreline protection feature. Superficially, CWPPRA projects approved by the Task Force appear to adequately and appropriately address the 30% of land loss attributed to shoreline erosion (Penland et al. 2000b). However in 1998, it was recognized that CWPPRA projects were misclassified nearly 20% of the time (Raynie and Visser 2002, Nyman 1998) and this trend continues. Twelve CWPPRA projects, not identified as having any shoreline protection feature, have placed nearly 22% of the total miles of stone placed by CWPPRA projects. The CWPPRA Adaptive Management Review conducted in 2002 questioned additional justifications for placing stone, such as water level and salinity control (Raynie and Visser 2002).

Stone is the dominant feature in over 79% of the shoreline protection projects, and approximately 65% of the projects with more than one project classification, one of which is shoreline protection, use stone. Stone usage is increasing within the CWPPRA program.

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7.4 Environmental Impacts of Using Stone

The type of stone used in CWPPRA projects is not native to coastal Louisiana, but is imported primarily from Arkansas, Missouri, Kentucky, and Tennessee. Issues associated with importing stone include energy consumption; land use changes and landscape alteration from the quarry footprint and supporting activities; and PM emissions from processing, quarrying and transporting the stone via barge to coastal Louisiana. A non-renewable resource (fossil fuel) is used to extract and process another non-renewable, but plentiful natural resource (stone). Stone quarrying and processing combined represent about 75% of uncontrolled PM 10 emissions – 70% if controls are implemented. By reducing the demand and avoiding the use of stone, particulate emissions would be significantly reduced, non-renewable resources conserved, and habitats in other areas would be preserved. Minimizing the transportation distances by seeking stone sources closer to the project site would not avoid the land use changes and resource depletion issues, nor significantly reduce emissions as transportation contributes less than 30% of the PM 10 emissions. The most effective recommendation in reducing the emissions and other environmental and ecological impacts of placing stone in coastal Louisiana is to ensure that it is used only when there are no other more sustainable alternatives that address the causes of land loss.

7.5 Process Improvements and Need for Engineering Monitoring

Improvements are needed in the CWPPRA project closeout procedures. Three readily implementable recommendations for the CWPPRA SOP include:

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- post-construction/project completion meeting;
- electronic as-built documents archive; and,
- five-year post construction project review.

By improving project closeout procedures, valuable lessons learned will be captured and data gaps reduced.

The CWPPRA Task Force established a monitoring program to evaluate the effectiveness of projects. Data gathered is primarily biological and ecological in nature and information is currently not being collected to compare the actual performance of stone features with the designed expectation. An engineering monitoring plan was developed and peer reviewed by NRCS and State of Louisiana engineers. Recommended project specific engineering monitoring includes post construction surveys, aerial photography, and field visits. LDNR already conducts annual site visits to CWPPRA projects in order to determine the need for maintenance. Expanding these site visits by having the design engineers participate and including additional data collection would provide much needed information to assess design assumptions and project performance. LDNR technical staff will also benefit from the valuable field training. Some aerial photography is already accomplished. Monitoring is not an inexpensive line item however by implementing a systematic data gathering approach for each project, costs can be minimized.

Although CWPPRA projects have a 20-year design life, their ecological and environmental impacts extend well beyond their project footprint and design life. Engineering designs need to consider the project's effect on surrounding areas and maintenance requirements extending beyond 20 years. Surveys used to monitor performance could also provide much needed data on localized elevation changes and/or impacts of stone placement on the existing marsh behind the structures. The current process of measuring the effectiveness of CWPPRA shoreline protection features using stone by measuring shoreline recession does not necessarily indicate progress in addressing land loss issues. A project's interaction with the local environment should be documented. In addition, continued use of stone within the CWPPRA program has implications that extend beyond coastal Louisiana shorelines. By examining performance, subsidence rates, and establishing the real causes for shoreline erosion, guidelines and recommendations regarding the applicability of placing stone in certain areas and soil types can be developed.

Additional measures include implementing aerial markers and labeling settlement plate riser pipes to facilitate aerial and field data collection. Project identification also provides an opportunity for on-going data collection from additional volunteer sources. All of the lessons learned from monitoring can result in future design efficiencies and improved structural performance, thereby reducing maintenance requirements. The CWPPRA Task Force should immediately allocate funds to the State of Louisiana to implement engineering monitoring on projects with stone features.

7.6 Hurricane Impacts

Hurricanes Katrina and Rita converted approximately 100 square miles of marsh to open water (USGS 2005). This preliminary estimate does not include areas west of

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Terrebonne Parish, the Biloxi marshes, and the Chandeleur Islands (USGS 2005). It is possible some of the marsh may recover. However, the land loss is probably permanent and the new open water areas may become lakes (USGS 2005). Storm events have positive impacts as well such as distributing sediments into the marshes and focusing attention on coastal Louisiana. Equipment shortages and resulting price increases are viewed as temporary and not considered in the economic analysis. Land loss along the Louisiana coast has been ongoing since the 1930s and storms will continue; similarly, restoration efforts will go on for decades.

7.7 Accomplishments

The research conducted and presented within regarding importing sediments has elevated interest in the CWPPRA federal agencies and LDNR. Samples, analyses, sediment information, and photographs have been shared as well as discussions regarding transportation logistics, estimated costs, environmental benefits, and placement impacts. The engineering monitoring plan was coordinated amongst state and federal design engineers and their comments/suggestions incorporated. Upon receipt of funding, it is likely a monitoring plan will be implemented by LDNR. A May 2006 presentation to the National Dredging Team meeting in Boston discussed coastal Louisiana land loss, and the possibility of importing sediments. Various attendees from other USACE Districts with established Regional Sediment Teams agreed the first step is increasing beneficial use by New Orleans District, and concurred that barging dredged materials is feasible.

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7.8 Additional Research

Additional information gathering and research are needed. Use of local borrow areas to restore marsh excludes the possibilities of future consequences due to present actions and may have unintended, severe consequences. Monitoring borrow areas should become a line item cost requirement for all future CWPPRA projects that specify a local borrow source. Funds should also be allocated to study local borrow areas historically used, such as Lake Pontchartrain, the source for the LaBranche Wetlands project. The minimum data gathering would include bathymetry and water column analyses. Dissolved oxygen, salinity, nutrients, and total suspended solids are some of the water quality parameters that should be measured.

Stone riprap is a commonly used construction material to address shoreline erosion, and slow down and/or prevent additional wetland loss; however, shoreline movement is not the only justification for stone usage. CWPPRA projects have used stone features in an effort to address interior marsh degradation due to the marine environment interacting with the fresh water intermediate environment; sea level rise; and subsidence. The final report from the Adaptive Management Review issued in December 2002 stated "there needs to be research to support the use of rock as an effective water control structure that can control salinities and water levels" (Raynie and Visser 2002). To date, no such research has taken place. The twelve projects listed in Table 2.2 that placed significant quantities of stone without a shoreline protection designation would be likely candidates for evaluation.

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The interior marsh behind the stone structures should be studied to determine the impacts of sedimentation, hydrologic/hydraulic exchange, and how the structure affects organisms. Survey data recommended in the engineering monitoring plan and placing sediment elevation tables in the interior marsh (Teague 2005) could be used to evaluate the ecological effects.

After implementing an engineering monitoring program, federal and state design engineers should review results in order to establish design guidelines. Analysis and follow-up data gathering is critical to continual improvement as presented in the PDCA cycle.

7.9 Future Implications

All CWPPRA projects have a 20-year post-construction design life, thus cost-shared maintenance and inspection funds are provided for only 20 years. The unanswered question the State of Louisiana should consider is what will happen to stone structures beyond their 20-year life? Without future federal appropriations, the State of Louisiana will have to address as much as 166 miles of CWPPRA revetments by:

- removing the stone;
- burying it;
- continuing to import tons of stone for maintenance events;
- abandoning the stone in place and marking it with navigation aids that must be maintained; and/or,
- combinations of the above.

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Removing the stone will cost more than its original placement. Burying it will disrupt fragile habitats trying to recover from initial construction activities. Perpetual maintenance will continue to demand resources. Abandonment of the structures presents navigational hazards that must be marked to avoid damages and liability claims from boaters that could further jeopardize commercial and sport fishing so vital to the State's economy. A long-term management plan should be developed as some projects are already completing one-half of their CWPPRA life.

Due to limited funding of approximately $50 million per year, the CWPPRA program is at best only capable of addressing the status quo land loss rate of 25 square miles per year. Continuing to implement three to four isolated restoration projects without a strategic restoration methodology results in a piece-meal approach, leaving the coastal area at risk. Difficult decisions with potentially severe socioeconomic implications must be made if significant land gains and major strides in ecological restoration are expected. Recent predictions of an increased rise in sea levels and concerns over the validity of historical benchmark elevations further invalidate the use of fixed, elevation dependent, structural barriers.

Even if all monetary restrictions were removed, placing sediments has limitations in addressing coastal Louisiana's land loss. In addition to the fixed quantity of sediment or sand available locally, a limited number of towboats and barges exist to import material for placement and navigation routes have capacities. Recognizing these realities and limitations, a strategic restoration methodology for coastal Louisiana is crucial and project locations should be carefully prioritized.

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7.10 Summary

Harvesting, importing, and placing sediment address the major portion of the land loss issue in coastal Louisiana. Raising the land elevation offers the best defense against ongoing subsidence and rise in sea level. Following initial land building, diversions of the Mississippi River will continuously sustain the restoration, nourishing the marshes and perpetuating vertical accretion. This philosophy mimics and restores historic and natural processes.

Landloss will continue in the future and the issues in coastal Louisiana are of national significance. It is reasonable and necessary to look outside of the local area for additional restoration tools. Minimizing the use of stone and importing sediments/sands is a "win-win" ecological, environmental, and sustainable solution to address a major portion of land loss in coastal Louisiana.

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